Bio-Optical Response and Coupling with Physical Processes in the Lombok Strait Region

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LONG-TERM GOALS

Our overarching long term goal is to understand the coupling of bio-optical processes and properties with physical processes in ocean regions of strong physical forcing. Strong physical forcing can include several processes such as wind forcing, tidal forcing, and in the case of this project, flow through archipelagos.

In addition, we desire to understand the relationship between optical signatures and the components of the water column that create these signatures. Biological, chemical, geochemical, and geological processes contribute to these signatures.

OBJECTIVES

The primary goals of this study are to understand:

1. The three-dimensional distribution of inherent optical properties in the Philippine archipelago, a relatively unexplored region of the world ocean for which relatively little optical data exist.

2. The coupling of bio-optical properties with the physical processes that contribute to and result from the dynamics of flow through straits and steep topography.

3. Relationship between the surface expression of three-dimensional ocean processes and the interior processes.

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4. The contribution of dissolved and particulate matter to in-water optical properties and their effect on ocean color remote sensing.

APPROACH

Our field approach to achieving the above objectives consistent of four observational components:

1. Three-dimensional physical/bio-optical mapping will be carried in regions of the archipelago where strong physical dynamics are expected. Optical sensors will be mounted on the UW-APL towed undulating vehicle for mapping 3-dimensional distributions of inherent optical properties that should respond to the physical processes of the straits. We will deploy a Wetlabs ACS hyperspectral absorption/attenuation meter, a Wetlabs BB9 9-wavelength backscatter sensor, and fluorometers for the measurement of CDOM and chlorophyll fluorometers.

2. Continuous nearsurface underway measurements of inherent optical properties will be obtained from the ship's underway seawater flow system. These measurements include unfiltered and filtered absorption/attenuation measurements using either Wetlabs AC9 or ACS instruments, spectral backscatter, and particle size spectra with the LISST-100. Both this set of measurements and the following item are important for interpreting remotely sensed ocean color observations.

3. Continuous ship-based measurements of "on the water" hyperspectral remote sensing reflectance will be obtained with a Satlantic HyperSAS system. The HyperSAS provides high spatial and spectral resolution of remotely sensed remote sensing reflectance without atmospheric interference, which is key to linking in water optical properties distributions with remotely sensed optical signals.

4. Station based high resolution vertical profiles of physical, inherent optical, and radeiometric optical properties will be obtained with a bio-optical profiler. These measurements will likely be made in conjunction with CTD-rosette casts to provide verification and interpretation of the in situ towed observations and the remotely sensed apparent optical properties.

5. Provide support for continuous near-surface underway measurements and measurements from the CTD rosette of a subset of inherent optical properties during cruises we do not participate in.

WORK COMPLETED

Acquisition and testing of new equipment required for the field experiment is nearly complete. Preparations are being made for the first Intensive Observational Period (IOP) cruise in February 2007.

A CDOM (colored dissolved organic matter) fluorometer and a single wavelength optical backscatter sensor were provided for deployment on the CTD system and for surface underway measurements during the PHILEX exploratory cruise that took place in June 2007. A limited set of observations were obtained on this cruise due to depth restrictions on the sensors.

We participated in several planning meetings pertaining to the program. Regions with tight physical forcing/biogeochemistry coupling were identified utilizing observations from the PHILEX exploratory cruise and ocean color images provided by Arnone.

RESULTS

As of yet, there are no results to report.

IMPACT/APPLICATIONS

The results of this effort will facilitate mapping and interpretation of physical dynamics associated with archipelago straits on the basis of inherent optical properties and remote sensing of ocean color.

Result will provide data on the optical properties of the Philipinne archipelago to the World Ocean Optics Database.

RELATED PROJECTS

1. Craig Lee et al. (UW) Trisoarus/Triaxus operations. Craig Lee and his group are responsible for the towed vehicle surveys that will be carried out as part of this program. We will coordinate our efforts directly with his group's effort. Our optical sensors will be deployed on the UW/APL tow vehicle. We have worked closely together on several cruises, are familiar with each others operations, and collaborate closely both on planning the field efforts and analysis of the data sets. http://iop.apl.washington.edu/

2. Robert Arnone (NRL) Remote Sensing – Robert Arnone is proposing to obtain and analyze remote sensing data (both AVHRR and ocean color data) for the cruise. We have worked closely with Arnone in the same efforts that we have collaborated with Craig Lee. We will work closely with Arnone and interpreting and correlating the satellite imagery with in situ observations physical and bio-optical observations.
http://www7333.nrlssc.navy.mil/

3. Arnold Gordon et al. (LDEO/Columbia) Hydrographic observations and modeling - We expect that our observations, coupled with the physical observations of Craig Lee will provide input and/or verification for the numerical modeling efforts of Ffield and Gordon.
http://www.ldeo.columbia.edu/res/fac/physocean/

4. Flament (UH) – The proposed HF radar effort of Flament and Poulain will be valuable for guiding and tuning the sampling plan for the towed vehicle mapping. In addition, this data set will provide valuable information for evaluating transport, identifying key features in the nearsurface circulation, and overall analysis of the data sets.
http://www.satlab.hawaii.edu/hfradio/